Dijet Resonances from Summer 08 MC

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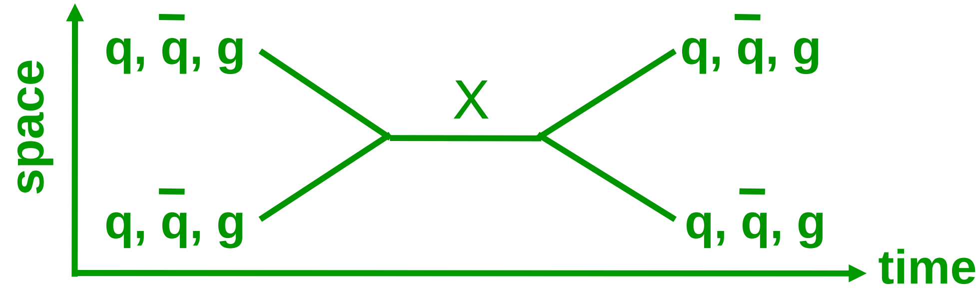
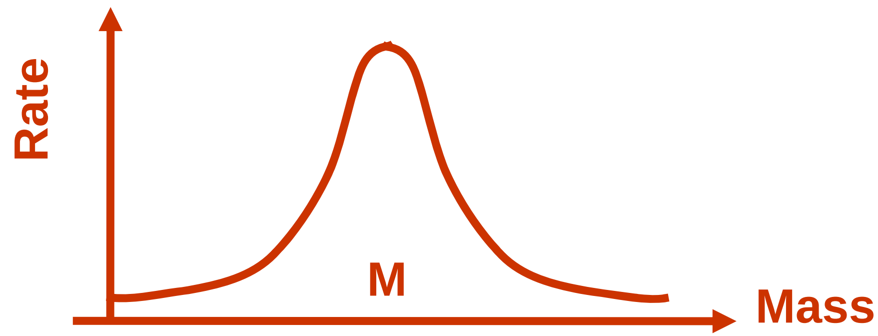
Dijet Resonance

New particles, X, produced in parton-parton annihilation will decay to 2 partons (dijets).



Signature: dijet resonances
→ mass bumps.



Resonances:

- Technicolor ===> Color Octect Technirho
- Grand Unified Theory ===> W' & Z'
- Superstrings & GUT ===> E_6 diquarks
- Compositeness ===> Excited quarks
- Extra Dimensions ===> RS Gravitons
- Extra Color ===> Colorons & Axigluons

Overview

- Getting ready to search for Dijet Resonances in the Dijet Mass Distribution.
- Need to have shape of Dijet Resonance at arbitrary mass.
  - For fits to possible resonance in data.
  - For limits in the absence.
- We have Simulated shape of resonances at a few fixed masses
- Interpolate to find arbitrary resonance mass

Analysis

- CMSSW_2_2_3 was used.

- There different qstar samples were used.

Exotica Summer08 GEN-SIM-RECO.

$$m_{q*} = 0.7\ \text{TeV},\ \ 2\ \text{TeV},\ \ 5\ \text{TeV}$$

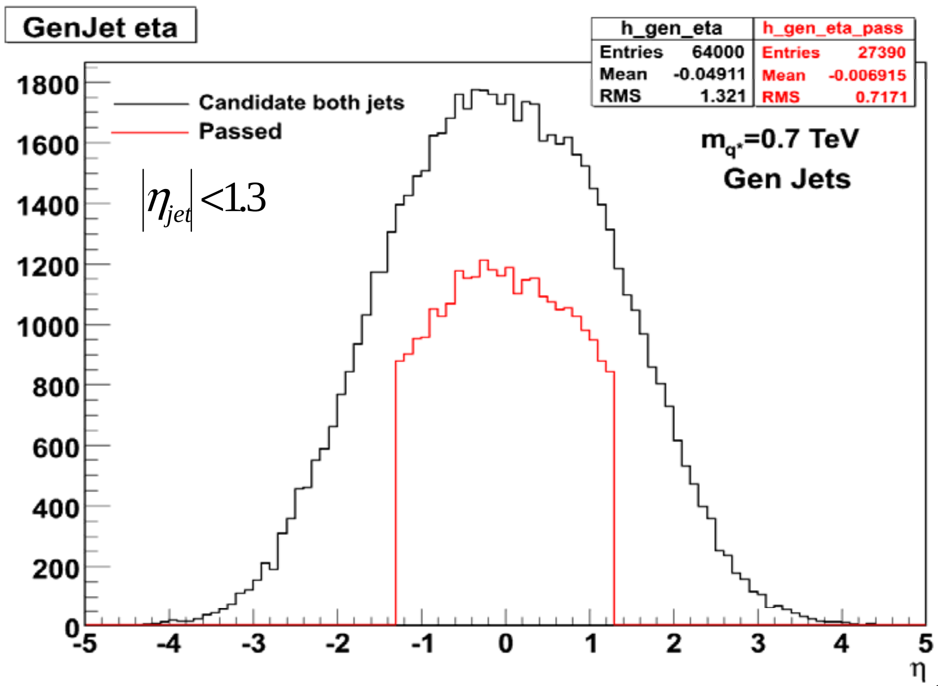
$$q* \longrightarrow qg$$

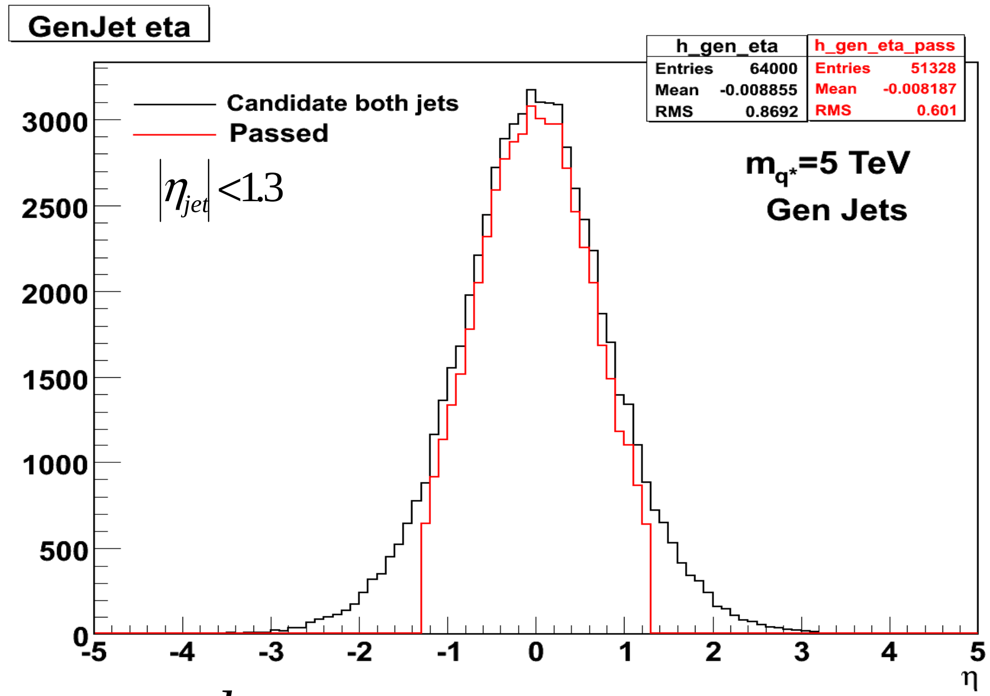
- SisCone R=0.7

- Pt and eta dependent jet correction were applied. (L2L3CorJets)

- Two leading jets with $|\eta_{jet}| < 1.3$ were selected.

Dijet Events Efficiency for Eta Cut





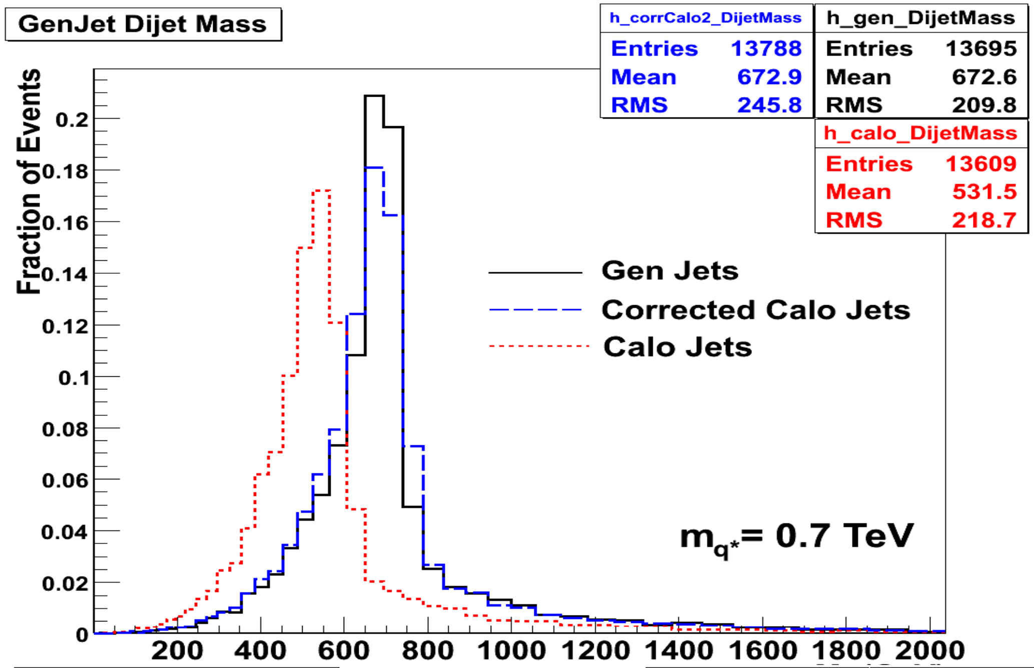
$$Efficiency = \frac{\#\,of\;\;accepted\;\;events}{\#\,of\;\;total\;\;events}$$

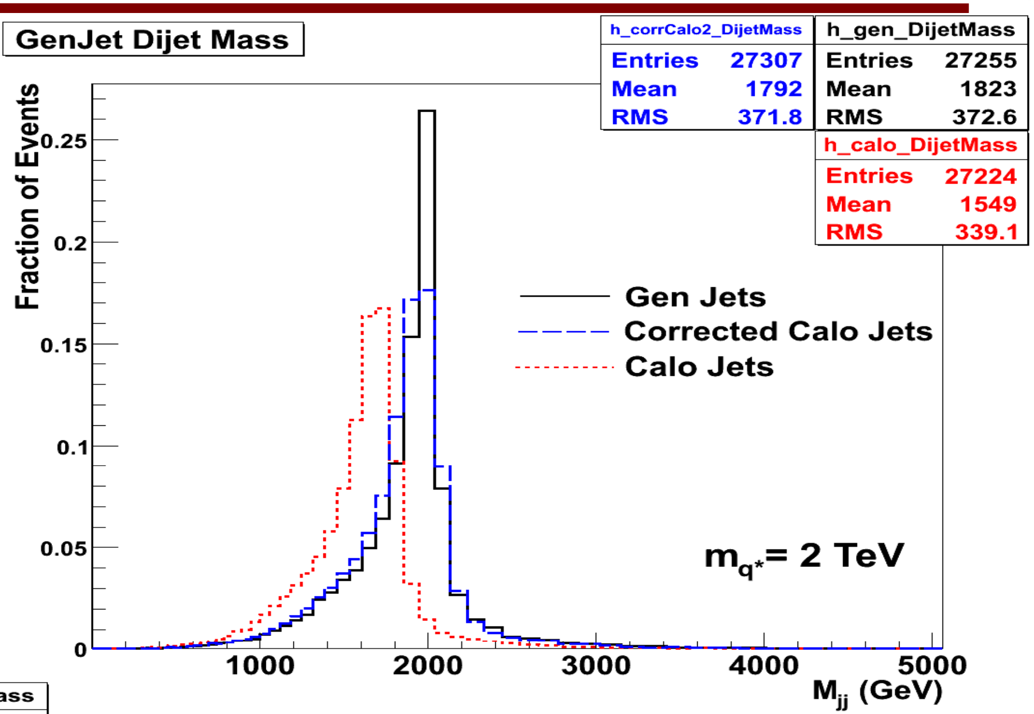
$$m_{q*} = 0.7\,TeV \;\rightarrow\; Eff. = 0.42 \qquad m_{q*} = 2\,TeV \;\rightarrow\; Eff. = 0.67$$

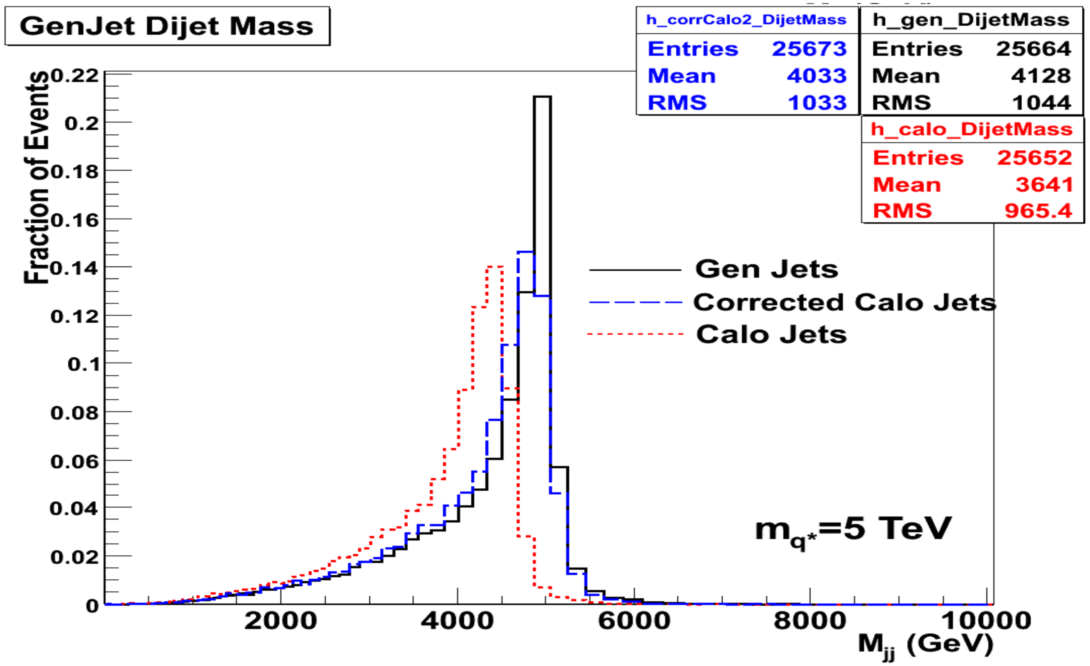
$$m_{q*} = 5\,TeV \;\rightarrow\; Eff. = 0.8$$

- Efficiency look like we expect from previous dijet resonance analysis.

Q* Resonance Shapes

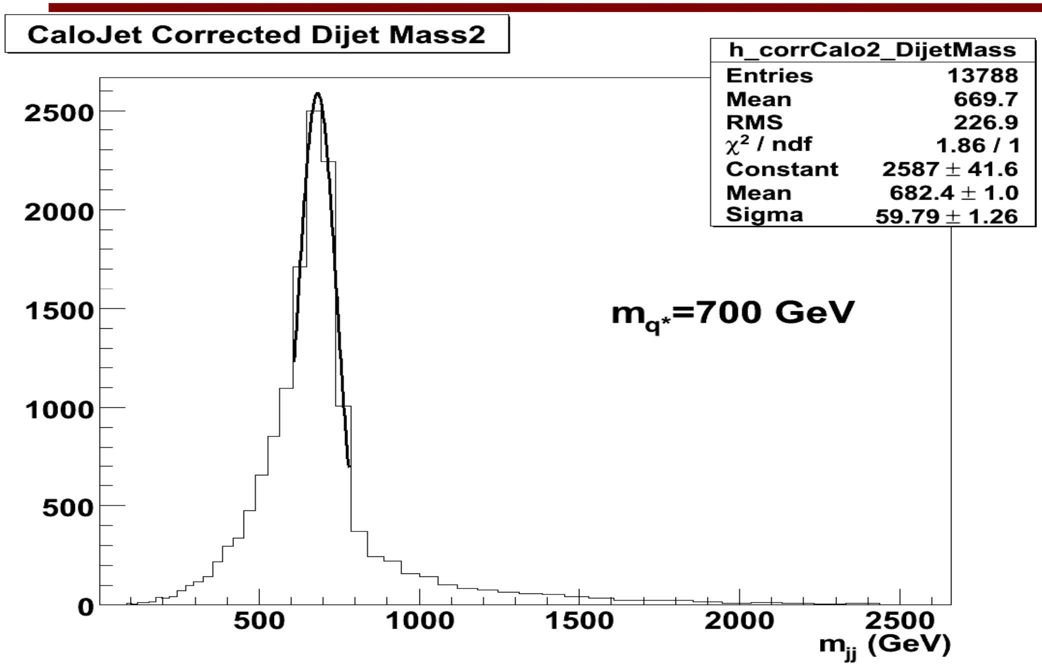






- Peaks are at expected resonance mass.
- Used same mass bins as dijet mass analysis.

Q* Shapes & Gauss Fit



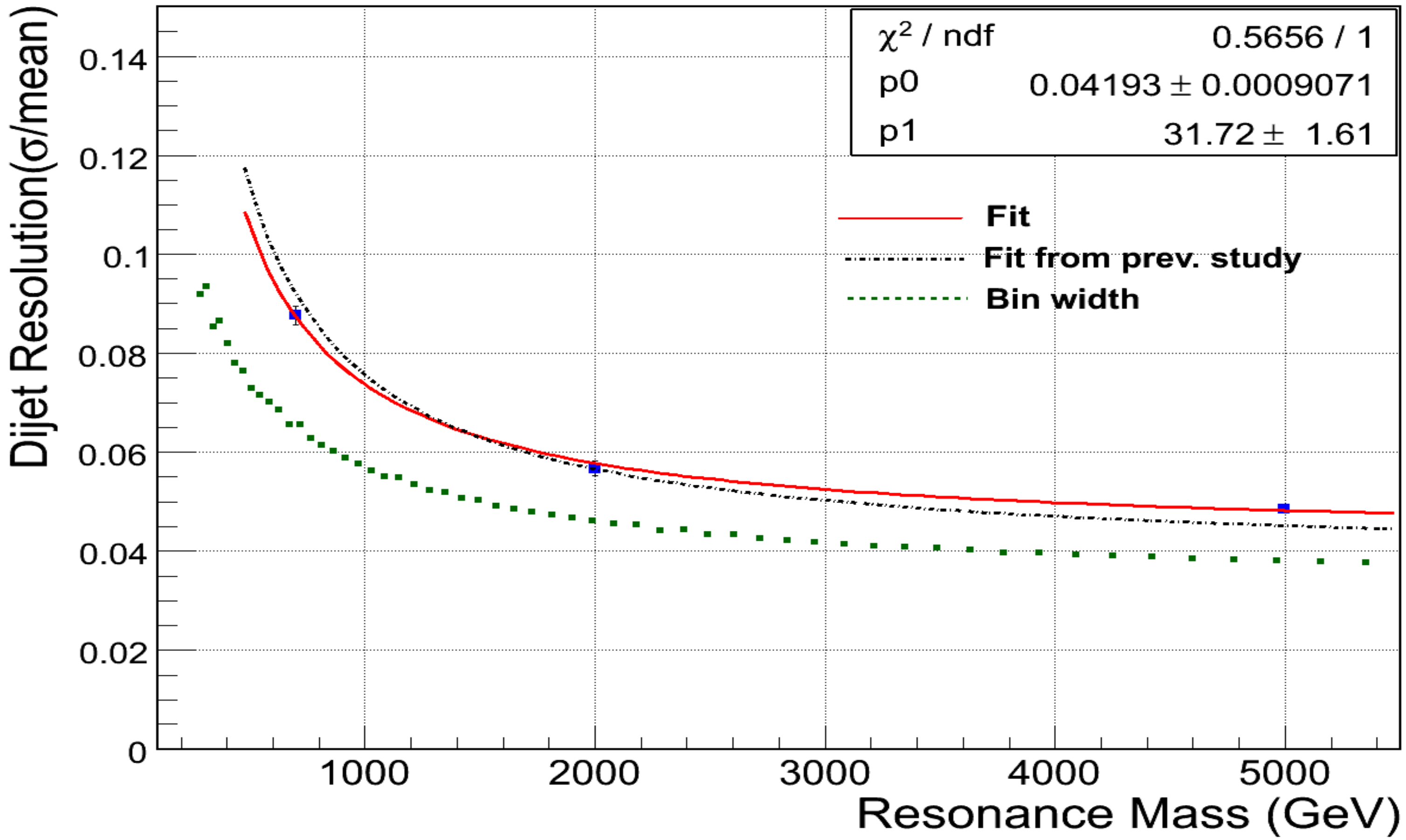
We fit a Gaussian to characterize resonance resolution and compare with previous studies.

Gaussian fit with range about mean from -1σ to +1.5σ

Dijet Resolution

- Resolution is similar to previous study. (AN-2007/034)
- Bin widths are about 75% of resolution which is fine.

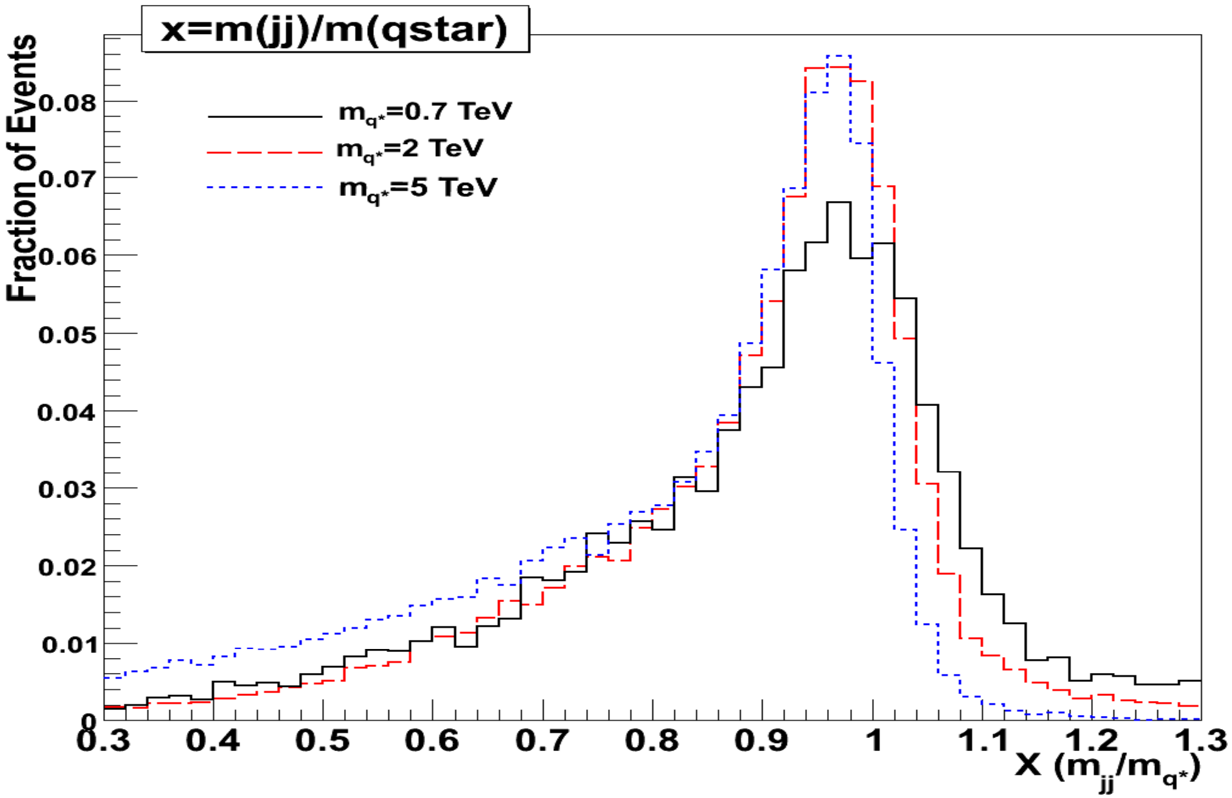
$$\frac{\sigma}{mean} = 0.042 + \frac{31.72}{M_{jj}}$$



Dijet Resonance at any M_{q*}

- We want to get shape of Dijet Resonance for any qstar mass value from the MC samples we have at 0.7, 2, 5 TeV.
- A new parameter (X) is determined in terms of qstar mass value.

$$X = \frac{M_{jj}}{M_{q*}}$$



- Resonances look very similar in X.

Dijet Resonance at any M_{q*}

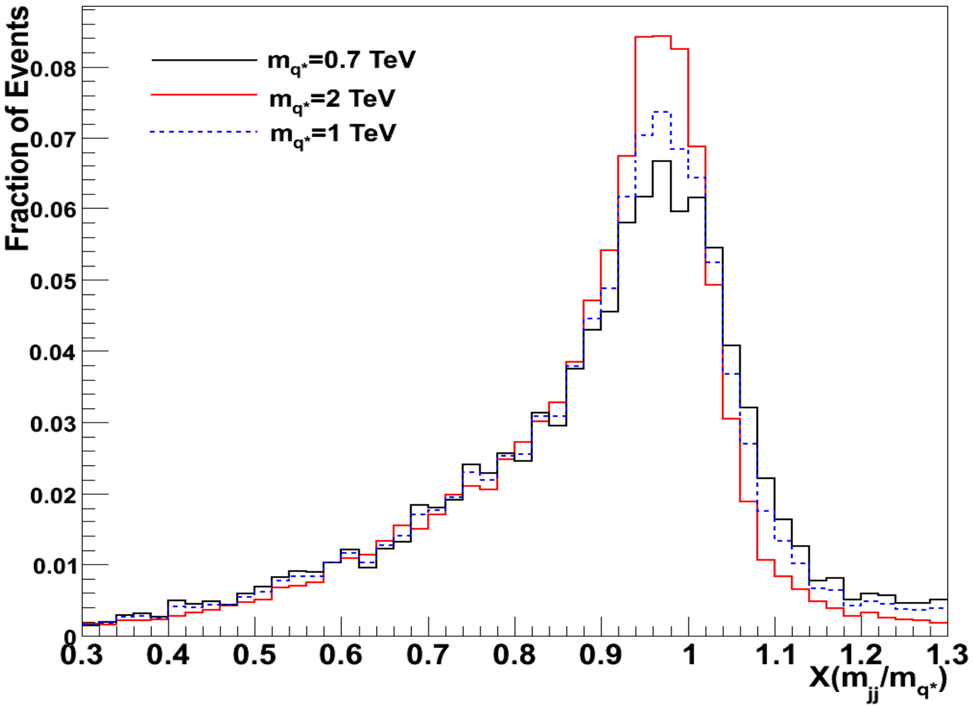
- Interpolation technique was used. For example,

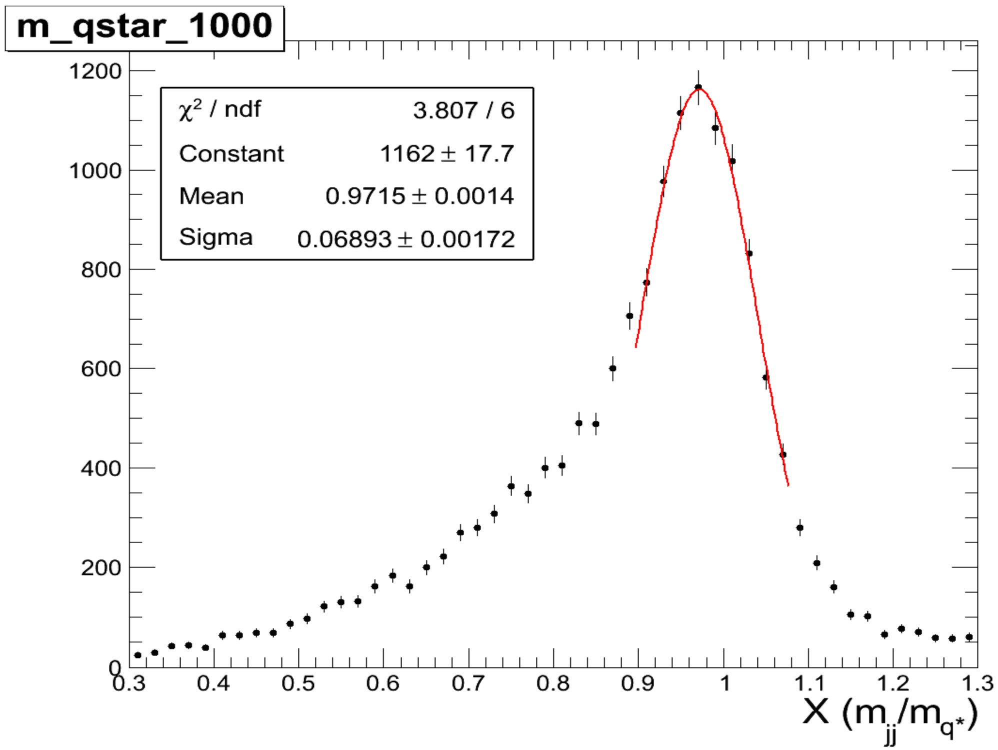
$$700\ GeV < m_{q*} < 2000\ GeV$$

$$\boxed{\Pr ob_{m_{q*}}(x) = \Pr ob_{700}(x) + [\Pr ob_{2000}(x) - \Pr ob_{700}(x)] \cdot \frac{m_{q*} - 700}{2000 - 700}}$$

- It gives us a resonance shapes at any mass between 0.7 and 2 TeV

m_{q*}=1 TeV from Interpolation





➢ Resonance shape at m_{q*}=1 TeV from interpolation is between the shape for m_{q*}=0.7 TeV and m_{q*}=2 TeV as it should be.

Conclusions and Future Plans

- We have measured q* mass distribution from Summer 08 MC samples.
- Resolutions are similar to previous studies.
- Variable mass bins are suitable for resonance searches.
- We have developed an interpolation technique to find resonance shapes at any mass.
- We can use this for searches and limits.
- Next step is to convert distribution in X to distribution in mass with variable bins.
- Then start to work on fitting for resonances in the dijet mass distribution using these shapes.